DEVELOPING ELECTRONIC MATHEMATICS MODUL ON THREE VARIABLES LINEAR EQUATION SYSTEM BASED ON SCIENTIFIC METHOD

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ABSTRACT

Teaching materials in the learning process can help students understand mathematical concepts and attract students' attention to schools' availability. This research aims to develop an electronic module material. By using canker sores. By using the appropriate system. This research development using the ADDIE method consists of Analysis, Design, Development, Implementation, and Evaluation. This study's subjects are material validator, media validator, and pupils of SMAN 1 Welahan and SMAN 1 Pecangaan district Jepara. The technique of data accumulation were interviews, questionnaires, and documentation. The data analysis technique used quantitative analysis was converted into a qualitative Likert scale. Result of research SPLTV material module electronic development for SMA / MA class X with the scientific method. Revised electronic module validation to 3 material experts with an average score of 74.67 from 90, then presentation 82,967%. Three media experts used a module quality research instrument sheet with an average score of 108,67 from 125. The percentage was 86,936%. Five students in the test are limited to SMAN 1 Pecangaan, five students of State Senior High School (SMAN) 1 Welahan, 33 students of SMAN 1 Pecangaan, and 33 students of SMAN 1 Welahan in-class test to measure student response to electronic module With the average score of students' SMAN 1 Welahan student response scores was 100,657 from 125 then the percentage was 80.526%. The student response rating of SMAN 1 Welahan was 93,388 from 125, and then the present rate was 74.7104%. This research has successfully developed an electronic module with good quality (B), with a score of 377,385 from 465 and a percentage of idealization equal to 81,158%. Based on the assessment, the electronic module has suitable for use as a module for students.

Keywords: Electronic Modul, three variable linear equation system, ADDIE

INTRODUCTION

The factor of education very much determines the quality of life of the nation. Therefore, the renewal of education must always be done to improve national education quality. To achieve the renewal of education must be adaptive to the changing times. According to Erni Lestari (2010), three main issues need to be highlighted in the context of educational reform: curriculum renewal, improvement in the quality of learning, and the effectiveness of learning methods. The education curriculum must be comprehensive and responsive to social dynamics, relevant, not overloaded, and accommodate the diversity of needs and technological advancements.

In some cases, the quality of learning must be improved to improve the quality of educational outcomes. At a micro level, effective learning strategies or approaches in the classroom must be found, which further empower students' potential. These three things are now the focus of the renewal of Indonesian education.

The 2013 curriculum wants a change in the teaching and learning process by positioning students as students rather than as objects of students making students more dominant in the learning process. In the 2013 curriculum, the teacher's role as a facilitator must provide services to students to develop their potential and excel by each student's potential. In improving the quality of education, the government also does not turn a blind eye to technology's rapid development because the use of appropriate technology can facilitate the teaching and learning process. Thus, the government also encourages the use of technology in learning. The government also improves facilities and infrastructure to support the learning process with integrity with technological developments. The improvement in facilities and infrastructure

is shown by the number of junior and senior high schools with computer and LCD laboratories in each class and even use the latest technology. Thus, learning is expected to be more effective because the learning process is more exciting and innovative.

The teacher is the only source of information for students. This results in an uncreative and not independent attitude for students. Not much different from students, teachers also generally only use makeshift learning resources. Their activities outside teaching and learning activities sometimes make it difficult for them to develop independent learning materials. Also, the material's density must be delivered. The limited-time of schooling sometimes results in the material not being delivered properly. With these obstacles, good management of learning strategies is needed to improve learning quality and achieve optimal learning goals. One component that influences learning is the use of media and learning resources. Media can be used in conventional learning (face to face) or independent learning. The use of media as a source of independent learning can enrich learners' learning experiences and learning experiences gained from conventional learning.

There is a unique feature in the media for independent learning that distinguishes it from conventional electronic modules. The self-contained electronic module must have a self-contained nature (containing all that is needed by students) and self-instruction (self-learning). With these characteristics, the media used for independent learning provides almost everything students need, including learning objectives, usage guidelines, material descriptions, digest, evaluation and feedback, and follow-up. With the completeness presented, students are expected to learn and understand the learning material without little help.

One of the media that meets these criteria is the module. With these various characteristics, it can be said that a module is a complete unit that stands alone and consists of a series of learning activities arranged to help students achieve several goals that are specifically and formulated. With modules, students can reach the mastery level (thorough) by learning individually. Students cannot proceed to the next unit of study before reaching the previous unit's whole study level. Modules are flexible so that they can be used anytime and anywhere, can also be done individually or in groups. The existence of modules can be one of the sources of learning planned for students. Most modules that are made are still lacking in facilitating students to learn the material available in the modules independently. In physical condition, most modules are in print with a relatively thick number of pages, too verbal presentation, and printing costs that are not small, causing the print module to be less desirable.

Advances in information technology have enabled a lesson developer to change the presentation of teaching materials. In this case, printed modules are packaged into modules in digital format or known as electronic modules. This term is included in the concept of electronic learning or e-learning. E-learning is a development of learning technology by utilizing computers and other information devices such as multimedia and the internet. The rapid development of information technology influences this form of learning. In essence, the development of e-learning leads to ease and completeness. The general concept of application in learning remains the same, namely providing a complete, structured, and exciting information presentation. Another advantage of the presentation of electronic modules is the relatively small file size, easy to carry only using a USB flash drive, smartphone, and so on. Electronic modules can be used off-line or on-line, depending on the readiness of educational institutions and students as users directly. Students can study modules anywhere and anytime provided, there is a computer. Even with the rapid development of technology can be accessed and studied through smartphones. Students can also know each learning's completeness by following the evaluation provided in the program.

SMA Negeri 1 Pecangaan and SMA Negeri 1 Welahan are some of the High Schools (SMA) in the Jepara Regency. Based on observations and interviews that have been conducted at SMA N 1 Pecangaan and SMA Negeri 1 Welahan. Many teachers still survive with ordinary learning without utilizing existing facilities. Only a few teachers have used technology to support learning. Also, many obstacles become obstacles to the smooth learning activities. The learning activities material for the 2013 curriculum, such as some of the Chapter Three Variable Linear Equation System's primary materials for students of class X SMAN 1 Pecangaan and SMAN 1 Welahan, obstacles have not been developed much.

The limited teaching materials and electronic modules used. Some things that result in a lack of learning that is prominent to be fixed include:

1. Submission of Linear Inequality and Inequality System material has not been maximized due to short student learning hours.
2. Most teaching materials are used without regard to the procedure of developing independent learning materials.
3. Students have not maximized using learning facilities as electronic modules or learning resources, electronic media (computers).

By carrying out, this research aims to develop an electronic module in electronic modules, especially in learning the Equation and Linear Inequality System for Class X SMA. Given the characteristics in this subject, which consists of introducing concepts and some practice introduction to using the program to develop existing concepts. In this study, the focus of development lies in presenting independent learning materials, including material management, display management, and student control. With the development of this electronic module, it is hoped that learning orientation will no longer be teacher-centered but instead leads to a student-centered learning system. Moreover, support the competence of graduates who can develop a concept of visual communication in digital media.

METHODS

This research is research and development (Research and Development). Development research is a research method to develop a new product or improve existing products and can be justified. This research focuses on developing electronic modules packaged in the form of Compact Disc (CD). Researchers use one of the development models to produce the right product, namely ADDIE (Analysis, Design, Development, Implementation, Evaluation). In detail, the ADDIE development method can be described by Figure 1.

Figure I. Flowchart of ADDIE Development Method

The explanation of the research steps above are:

1. Analysis. The ability to parse the concept and explain the interrelationships of components contained in it (Benny A. Pribadi, 2011: 168). There are several things analyzed in this development model, viz
   a. Situation Analysis. Situation analysis is carried out to determine the school's condition used as an object of research by observing several necessary things, such as computer laboratories and school mathematics teachers.
   b. Material Analysis. Analysis of the material in this case by selecting mathematical material included in the Electronic Module by consulting a mathematics teacher to be conducted research.
   c. Technology Analysis. Technical analysis is carried out to find out the software suitable for researchers' ability and the need for developing Electronic Modules.
2. Design. An overall picture, structure, framework or outline, sequence, or systematic activity (Benny A. Pribadi, 2011: 169). In the design step, the researcher designs electronic modules to make the media's systematics or flow more directed and produce better media. After the design is done, the tools used also need to be determined, such as audio, video, computers, the internet, etc.
3. Development. The third step in implementing the ADDIE learning system design model. The development step includes making, buying, and modifying teaching materials or learning materials to achieve the specified learning objectives in this stage, typing material and script exercises about

making animation, pictures, navigation buttons, and giving music. After the electronic module development produces the initial product, the media is validated by the material expert and the media expert to assess the developed electronic module's feasibility. After that, a revision is made by the input from the material experts and media experts in the validation process. After all, aspects are judged to be feasible. The revised product is tested on a limited trial to respond to the product. Suppose there is still some input from a limited trial. In that case, the product will be revised to improve the product before being tested in a broader field test. The development process at this stage can be seen in Figure 2.

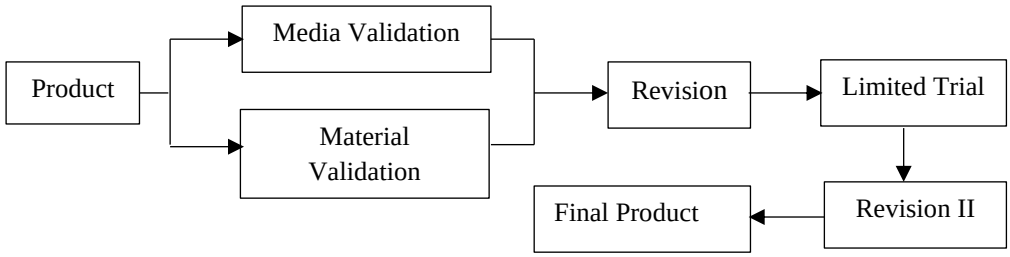

Figure 2. Electronic Module Eligibility Validation Flow

4. Implementation. The implementation step is often associated with the implementation of the learning program itself. This step does have the meaning of delivering learning material from the teacher or instructor to students using the Electronic Module prepared and validated by experts. Then students who take part in the implementation fill in the questionnaire responses to the Electronic Module. Implementation is the fourth step in the ADDIE development model.
5. Evaluation. The final or fifth step of the ADDIE learning system design model is evaluation. Evaluation can be defined as a process carried out by someone to assess something, in this case, the Electronic Module (Benny A. Pribadi, 2011: 133). An evaluation can be carried out throughout the implementation of the five steps in the ADDIE model. With the data obtained by researchers from the development of the electronic module, the researcher determines its feasibility using ideal product feasibility in Table 1.

Table 1. Table of criteria for ideal rating categories

Qualitative score range	Qualitative Category
$X > \bar{X}_i + 1{,}8\ SB_i$	Very Good
$(\bar{X}_i + 0{,}6\ SB_i) < X \leq (\bar{X}_i + 1{,}8\ SB_i)$	Good
$(\bar{X}_i - 0{,}6\ SB_i) < X \leq (\bar{X}_i + 0{,}6\ SB_i)$	Pretty good
$(\bar{X}_i - 1{,}8\ SB_i) < X \leq (\bar{X}_i - 0{,}6\ SB_i)$	Less
$X \leq (\bar{X}_i - 1{,}8\ SB_i)$	Very Less

(Sukarjo, 2006 : 53)

Information:

$\bar{X}_i$: ideal average

$\bar{X}_i$: $\frac{1}{2}$ x (ideal maximum score + ideal minimum score)

Sb_i : ($\frac{1}{2}$ x $\frac{1}{3}$) x (ideal maximum score - ideal minimum score)

Sb_i : ideal standard deviation

Ideal maximum score: $\sum$ criterion item xi highest score

Ideal minimum score: $\sum$ lowest score xi criterion points

RESULTS AND DISCUSSION

The data obtained from the results of research, which is qualitative, is processed into quantitative data. The data is divided into four assessment sections: assessments from experts, student responses, and the electronic modules' overall quality. The results of the electronic module assessment of various aspects will be explained as follows,

The learning material's feasibility was assessed by three material experts, namely Ahmad Dahlan University lecturer in Algebra, mathematics teacher at SMAN 1 Welahan, and mathematics teacher at SMAN 1 Pecangaan. The results of the eligibility questionnaire calculations by material experts can be seen in Table 2.

Table 2. Results of the Questionnaire Calculation of Material Expertise

No	Assessment	Score	Qualitative Criteria
1	Material expert 1	72	Good
2	Material expert 2	77	Good
3	Material expert 3	76	Good
	Mean	74,67	Good

Based on Table 2, it can be seen that the average score of the results of the material expert assessment is 89.666. These results indicate that the developed electronic modules in terms of material included in both categories

The electronic module's feasibility was assessed by three media experts, namely Ahmad Dahlan University lecturer in multimedia computers, ICT teacher at SMAN 1 Welahan, and ICT teacher at SMAN 1 Pecangaan. The electronic module eligibility questionnaire calculation results can be seen in Table 3.

Table 3. Results of the Questionnaire Eligibility Calculation for Media Experts

No	Assessment	Score	Qualitative Criteria
1	Material expert 1	94	Good
2	Material expert 2	116	Very Good
3	Material expert 3	116	Very Good
	Mean	108,67	Very Good

Based on Table 3, it can be seen that the average score of the results of the assessment of media experts is 108.67. These results indicate that the developed electronic module in terms of media appearance is included in both categories.

Student responses to the developed electronic modules are known based on the questionnaire results given and filled out by students during limited trials and large class trials. The questionnaire calculation of student responses to the electronic module can be seen in Table 4.

Table 4. Results of Calculation Questionnaire Responses of SMAN 1 Welah Student Responses

No	Activity	Average Score	Qualitative Criteria
1	Limited trial	104,4	Good
2	Research class test	96,914	Good
	Mean	100,657	Good

Table 5. Questionnaire Calculation Results for SMAN 1 Pecangaan Student Responses

No	Activity	Average Score	Qualitative Criteria
1	Limited trial	95,2	Good
2	Research class test	91,576	Good
	Mean	93,388	Good

Based on Table 5, it can be seen that the student's response to the electronic module is excellent, indicated by a score of 55.4 in a limited trial and the research class test with a score of 55 included in the excellent category. Determination of the electronic mathematics module's quality is based on the assessment of 2

material experts, two media experts, five students in a limited trial, and 22 students in a research class test. The data obtained is analyzed to determine the quality of the electronic module.

Experts' data and students' qualitative data assessment are transformed into a quantitative form based on the data analysis technique. The resulting quantitative data is then tabulated and analyzed for each assessment instrument. The final score obtained is converted to a qualitative level of product eligibility using ideal assessment criteria. Based on the ideal assessment criteria obtained by the electronic mathematics module's quality from each aspect of the assessment presented in Table 6.

Table 6. Percentage of Ideals and Quality of Each Aspect of Electronic Modules

No	Aspect	Score Average	Percentage of ideals	Percentage of ideals	Category / Quality	Category
1	Material	74,67	90	82,97%	B	Worthy
2	Media display	108,67	125	86,94%	SB	Worthy
3	Student Response SMAN 1 Welcome	100,657	125	80,53%	B	Worthy
4	Student Response SMAN 1 Pecangaan	93,388	125	74,71%	B	Worthy
	Total	377,385	465	81,16%	B	Worthy

The final assessment score obtained for the electronic mathematics module developed is 377,385 from a maximum score of 465 with an ideal percentage of 81,158%. It has good quality (B). So, the product developed is considered feasible to be used as a mathematical, electronic module. After the electronic module, products have been revised once after getting input from material experts and media experts. After a revision, a limited trial and research class test were conducted to determine the student's response to the electronic module. The resulting electronic module consists of 2 Learning Activities. In the Electronic Module, there are also evaluation or practice questions.

CONCLUSION

The Electronic Module Competency of the Three Variable Linear Equation System for high school students is declared feasible based on the assessment of media experts, material experts, and students. The assessment carried out resulted in the media in the Good category, with a score of 377,385 from an ideal maximum score of 465 and an ideal percentage of 81.158%.

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